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Jørgensen, Kirsten

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SERIOUS WORK ACCIDENTS AND THEIR CAUSES – AN ANALYSIS OF DATA FROM EUROSTAT

KIRSTEN JÖRGENSEN
Denmark Technical University, DTU

ABSTRACT

In the two years 2009-2010 EU countries reported a total of 4.5 million occupational accidents with more than three days absence from work to Eurostat, the Statistical Office of the European Communities (Eurostat 2013,1). The European database offers comparable statistics on accidents at work by economic activity and severity for the EU27 countries from this period and Norway. (Eurostat request DK533) The individual countries estimated their underreporting to be between 33% and 40% which means that, if this underreporting is accounted for, around 3.5 million of work accidents are taking place in Europe each year. Despite the uncertainty of the data collected by Eurostat over two years stile provide a picture of the seriousness of the accidents, the sources of risk and the events taking place when the accidents occur.

Data from Eurostat were analysed to find out which hazards and accidental events led to serious consequences. The aim was to determine which accidental events should be prioritised for prevention and to make recommendations regarding suitable risk reduction methods. There are many different hazards and accidental events each of which requires a different form of prevention.

Accidents associated with more complex event sequences related to Major hazards (electrical problems, explosion, fire) cause only a small proportion of the accidents(11%) whereas related to Minor hazards realised through simpler accidental event sequences dominate with 42% attributable to body movements, 23% to slips, trips and falls and 21.5% to loss of control of machines and tools. Only 12 % of the fatalities and 2 % of long term sick leave were caused by the more serious hazards while the rest by the more minor hazards.

The Minor hazards and simple accidental events need more awareness if the goal to reduce the number of severe consequences is to be obtained.

Highlights:

- Simple accidental events can cause serious consequences.
- The simple events causing accidents are a part of most people's daily working life.
- Risks from different hazards have to be controlled by different types of safety barriers.
- Prevention of different types of accidental event requires different preventive strategies.

Keywords: Serious accidents, European data, Accident deviation and mode of injury, High risks versus simple risks

1. INTRODUCTION

Heinrich's triangle model of injuries (Heinrich 1931) is reflected in most countries' statistics, including EU statistics (Eurostat 2013,1), showing that a form of pyramidal relationship exists between the number of more serious consequence accidents like fatal and disabling accidents and those with less serious consequences. Emphasis on minimizing serious accidents, understood as those with serious consequences, would mean that one would focus on long absence, disability or death. Heinrich´s intention was to show that one can learn from the many minor accidents to prevent the more serious accidents. The question is whether one can usefully apply this

concept to the many accidents available in the Eurostat database or whether a different strategy is required. An accident at work can be defined as a discrete occurrence in the course of work which leads to physical or mental harm (Eurostat 2013,2). The concept "Accident" can also be defined as occurring as the result of a series of events that leads to an unexpected sudden event in which a person is injured by exposure to a hazard (Jørgensen 2008). The concept "injury" is in this paper understood as the harm or trauma the event caused the victim.

The prevention of accidents has been addressed by many different theories and models but, regardless of which is used, part of the solution generally has an element of identification and assessment of risks, including the opportunities for accidental events that could lead to exposure to hazards that may cause harm for people (Glendon et al 2007). The basis for risk analysis varies to some extent according to the nature of the risk (Rasmussen & Svedung 2000). The hazards of nuclear power, oil and gas, chemical manufacture, rail transport and shipping for example are all associated with the potential for severe harm to many people and the environment. This kind of hazards is also named "Major hazards; because the consequences could be great there are major efforts to minimize the likelihood of such accidents occurring. In contrast, work activities that do not pose the same degree of consequence severity, such as in agriculture or construction, can be described as "Minor hazards" because in most cases accidents lead to recoverable injuries to single individuals. Such accidental events occur quite frequently and may not require reporting to the regulator unless they are particularly serious. The reduction of the number of accidents at work is usually focused on minimizing the risks of the more severe consequences at the expense of action on minor ones. For example Woodruff (2005) points out that OH&S decision making in the UK is often more influenced by consequence than risk, despite the UK's risk-based approach.

The goal of the analysis presented below is an attempt to explore, for the purposes of prioritizing prevention, the number and consequences of reported occupational accidents and to identify any relationships between accident hazard types and causes in the serious occupational accident data which are available from Eurostat.

The goal is also to show that accidents with serious consequences happen in all type of accidental events (as classified by type of accident scenario) and to show that accidents with serious consequences (deaths + permanent injuries + absence more than 6 months) happen in absolute numbers more often by Minor hazards likefalls, trips, hit against, etc. than accidents connected with Major hazards.

2. DATA FROM EUROSTAT

In 2011 the EU agreed what information should be collected in the member countries regarding work accidents (European Commission 2011) although for a long period before that several member countries had already implemented the collection of such information. The harmonised and common micro-data set to be provided on accidents at work from all member states in the EU cover the following subjects (Eurostat 2013,2):

- Characteristics of the injured person
- Characteristics of the injury (the trauma), including severity (days lost)
- Characteristics of the enterprises
- Characteristics of the workplace
- Characteristics of the accident including the events characterising the causes and circumstances of the accident.

The special part of the ESAW data is the method for data collection about the causes and circumstances of the accident. The method used is based on a grammatical view. The collected information cover:

- 1. Step: The activity, the victim was carrying out at the moment the accident happen.
- 2. Step: The accidental mechanism, what went wrong, that made the accident happen.
- 3. Step: The injuring mechanism, which causes the injuring in the very end.

The information you collect is further more a combination of the verb and the corresponding noon, which is the basic and ingenious idea in the method. The data to collect from the accidents will therefore be as following:

1. Step-activity	
Activity of the victim, e.g. operating a machine, performing maintenance, driving, walking etc.	Component related to the activity of the victim e.g. power press, tool, vehicle, floor etc.
2. Step-accident mechanism	
Deviation, e.g. explosion, brakes, falls, slips, loss of control etc.	Component related to deviation, e.g. pressure vessel, wall, cable, vehicle, machine, tool, etc.
3. Step-injuring mechanism	
Mode of injury, e.g. struck by, crushed, trapped, in contact with, bitten by etc.	Component related to mode of injury, chemicals, knife, ground, machine, tool, etc.

Primarily two aspects of these data are interesting for the purpose of this paper, namely:

- The severity of the consequences covering information about fatalities, invalidity or number of days lost. The classification is shown in appendix 1.
- The events which cover information about the deviation (what went wrong) and the contact mode of injury (how the victim was injured). The classifications are 2 digits long, but only the top level is used in the analyses as shown in appendix 2 and 3.

The data from the special request (Eurostat request DK533) cover registration of information from 28 European countries (EU27 + Norway). However, four countries do not register “deviation” (Denmark, France, Netherlands and Norway), while three do not register “contact mode of injury” (France, Netherlands and Norway). As the data were collected for two years and from 28 European countries (EU27 + Norway), it can be assumed that the distribution shown for accident events and their occurrence and severity can be considered valid and generic across Europe.

3. METHODOLOGY

Since information of special interest relates to the data on ”deviation”, ”contact mode of injury” and ”severity”, a set of tables presenting such data was requested from Eurostat for the years 2009 and 2010, which are the latest available data not yet previously published. The data received from the special request (Eurostat request DK533) were long tables for each variable on the lowest level of digit classification for all countries together as well as for each country separately. These data were transformed into MS Excel for the purpose of analysis; this was to connect either deviation or contact mode of injury to the severity on a general level with the aim of identifying the type of event that prevention should focus on for minimizing the most serious consequences.

4. RESULTS

4.1 Overview of seriousness of accidents

Eurostat’s special request (Eurostat request DK533) for the 27 member countries + Norway show 4,381 fatal accidents in 2009 and 4,567 fatal accidents in 2010 and a registered number of non-fatal work accidents of 4,499,437 for the two years (2,435,979 in 2009 and 2,054,510 in 2010). On the basis of the evaluation of underreporting in the individual countries, it is judged that these figures reflect around 3.5 million work accidents annually.

Table 1 shows the distribution of the 4,499,437 accidents recorded in 2009 and 2010 by the 27 EU Member States + Norway. The distribution follows the EU classification of severity in appendix 1.

Table 1 Registered accidents at work in 2009-2010 reported to Eurostat from 27 EU countries + Norway according to severity of the accidents.

Severity:	**Fatal**	**Permanent invalidity**	**3-6 months**	**1-3 months**	**14-30 days**	**4-13 days**	**Unknown**	**Total**
Year 2009	4,381	98,771	102,116	439,358	604,386	906,396	284,952	2,440,360
Year 2010	4,567	83,294	83,230	369,126	506,760	744,500	267,600	2,059,077
Total	8,948	182,065	185,346	808,484	1,111,146	1,650,896	552,552	4,499,437
Percentage of total	0.2 %	4.0 %	4.1 %	18.0 %	24.7 %	36.7 %	12.3 %	100 %
Ratio to 1 fatality	1	20	21	90	124	184		

It might be expected that the distribution of injuries according to their severity as shown in the last row in the table would resemble the Heinrich scale. If the consequence of 3-6 months absence is added to permanent invalidity to make one category of the most serious non-fatal injuries the ratio becomes 1:41:90:124:184 in relation to 1 fatality compared to Heinrich's scale of 1:29:300 of major to minor to no injury accidents (Heinrich 1931). Figure 1 shows a comparison with the all country data and some selected countries. The steeper the slope the higher is the ratio to 1 fatality.

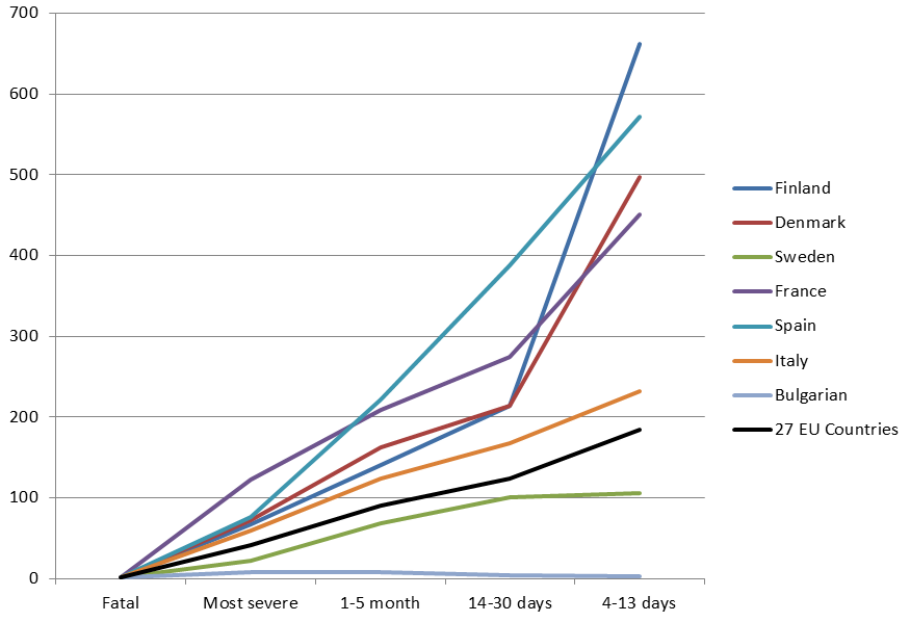

Figure 1 Accident ratios to 1 fatality of some selected European countries and all countries together for the years 2009-2010

Figure 1 illustrates, on the one hand, Heinrich scale, as it operates in relation to the severity of the consequences of accidents. But the figure also illustrates the large differences between countries, where there may be differences between the accidents to register, but it can also illustrate the differences in the overall safety achieved in each country. The numbers alone cannot determine what the explanation is on the differences seen in the figure.

4.2 The deviation

In the Eurostat system the "deviation" expresses what went wrong at the moment of the accident. The definition of deviation is the abnormal event or the last link in a chain of abnormal events that triggers the accident. The deviation is registered according to a two-digit classification (see appendix 2 for the first digit classification). A total of 36.8 % of the accidents provide "no information" on deviation. As shown in table 2, these are accidents in all categories of severity.

Table 2 Registered accidents at work in 2009-2010 reported to Eurostat from 27 countries + Norway, showing severity of the accidents and whether information about the deviation was provided.

	Fatal	Most serious non fatal injuries	1-3 months absence	14-30 days absence	4-13 days absence	unknown	Total
No information about the deviation	2,196 (24.5 %)	159,802 (43.5 %)	301,486 (37.3 %)	404,118 (36.4 %)	653,030 (39.6 %)	135,880 (24.6 %)	1,656,512 (36.8 %)
With information about the deviation	6,752 (75.5 %)	207,609 (56.5 %)	506,998 (62.7 %)	707,028 (63.6 %)	997,866 (60.4 %)	416,672 (75.4 %)	2,842,925 (63.2 %)
Total	8,948 (100 %)	367,411 (100 %)	808,484 (100 %)	1,111,146 (100 %)	1,650,896 (100 %)	552,552 (100 %)	4,499,437 (100 %)

A total of 63.2 % of the accidents have data about the deviation. Table 3 shows data for 2009 and 2010 from the 27 European countries + Norway distributed for the deviation information (first digit level) and the accident's severity. The order of the deviation follows the classification order in appendix 2.

Table 3 Eurostat registered accidents at work in 2009-2010 reported to Eurostat from 28 countries, according to severity of the accident and the type of deviation. The percentages are made for the columns.

Deviation 2009-2010	Fatal	Most serious nonfatal injuries	1-3 month sick leave	14-30 days sick leave	4-13 days sick leave	Unknown	Total
10.Deviation due to electrical problems, explosion, fire	396 (4.4 %)	1.441 (0.4 %)	2.584 (0.3 %)	4.178 (0.4 %)	5.311 (0.3 %)	2.575 (0.5 %)	16.485 (0.4 %)
20.Deviation by overflow, overturn, leak, flow, vaporization, emission	132 (1.5 %)	2,047 (0.6 %)	5,953 ((0.7 %)	12.300 (1.1 %)	30,864 (1.9 %)	3.288 (0.6 %)	54,584 (1.2 %)
30.Breakage, bursting, splitting, slipping, collapse of Material agent	1,058 (11.8 %)	22,404 (6.1 %)	48,350 (6.0 %)	63,391 (5.7 %)	95,151 (5.8 %)	19,399 (3.5 %)	249,753 (5.6 %)
40.Loss of control of machine, means of transport or handling equipment, tools, object,	2,595 (29.0 %)	38,052 (10.4 %)	107,923 (13.3 %)	149,962 (13.5 %)	221,222 (13.4 %)	91,428 (16.6 %)	611,182 (13.6 %)
51.Fall to lower level	1,034 (11.6 %)	23,421 (6.4 %)	35,253 (4.4 %)	35,292 (3.2 %)	34,774 (2.1 %)	31,357 (5.7 %)	161,131 (3.6 %)
52-59.Fall on same level and other falls	270 (3.0 %)	49,802 (13.6 %)	106,037 (13.1 %)	114,322 (10.3 %)	131,018 (7.9 %)	99,819 (18.1 %)	501,268 (11.1 %)
60.Body movement without any physical stress (generally leading to an external injury)	448 (5.0 %)	29,677 (8.1 %)	85,534 (10.6 %)	130,982 (11.8 %)	195,701 (11.9 %)	43,318 (7.9 %)	485,660 (10.8 %)
70.Body movement under or with physical stress (generally leading to an internal injury)	98 (1.1 %)	32,657 (8.9 %)	96,186 (11.9 %)	167,724 (15.1 %)	238,144 (14.4 %)	89,685 (16.3 %)	624,494 (13.9 %)
80.Shock, fright, violence, aggression, threat, presence	321 (3.6 %)	4,515 (1.2 %)	11,048 (1.4 %)	14,861 (1.3 %)	23,237 (1.4 %)	23,710 (4.3 %)	77,692 (1.7 %)
99.Other deviations not listed above	400 (4.5 %)	3,593 (1.0 %)	8,130 (1.0 %)	14,016 (1.3 %)	22,444 (1.4 %)	12,093 (2.2 %)	60,676 (1.3 %)
Total	8,948 (100 %)	367,411 (100 %)	808,484 (100 %)	1,111,146 (100 %)	1,650,896 (100 %)	552,552 (100 %)	4,499,437 (100 %)

Table 3 shows that the highest number of deviations is occurring for loss of control of equipment (40). Looking across the data in the table the following points can be made:

1. Dangerous events connected to deviations 10 and 20 are due to electrical problems, explosion, fire, deviation by overflow, overturn, leak, flow, vaporization, emission. These events cause 1.6% (71.069) of the accidents. Within this group they are more weighted towards the fatal accidents; these kinds of events can undoubtedly have serious consequences when they lead to accidents, but actually this does not happen so often when compared to other deviation categories.

2. Events connected to deviation 30 due to breakage, bursting, splitting, slipping, and collapse of material agent), are events that also include very dangerous hazards. These events cause 5.6% of the accidents, but 11.8% of the fatalities. Again these are events which tend to have serious consequences when they happen, but which do not happen so often.

3. Events connected to deviation 40 due to loss of control of machines, means of transport or handling equipment, tools, objects, are risks that have great focus in prevention of work accidents. The events connected with the use or design of technical equipment causes 21.5% (611,182) of the accidents and the share across the different categories of severity are very equally distributed, except for fatal accidents. Almost 30% (2,595) of the fatal accidents occur in connection with use of technical equipment.

4. Events connected to deviation 50 which include all forms of falls, both at the same level and to lower levels. The events connected with falls cause 23.3 % (662,399) of the accidents. Here the difference in the seriousness of the injuries lies in whether the fall happens on the same level or to a lower level. 12% (1,034) of the fatal accidents are caused by fall to a lower level, whereas 3% (154) involve a fall on the same level. However, 11 % (431,109) of all accidents occur due to a fall on the same level. Similarly, falls to lower levels comprise 4% (161,131) of all accidents. This show that falls is just as important a problem as the use of technical equipment when looking at accidental events.

5. Events connected to deviations 60 and 70 are due to body movement with or without physical stress – generally leading to external injury. Events connected with these body movements cause 24.7% (1.100.154) of the accidents. The injuries are mostly less serious although these risks do comprise 6 % of the fatalities and 17 % of the most serious injuries.

6. Events connected to deviation 80 due to shock, fright, violence, aggression, threat, presence, where people's behaviour plays a large role and the events are difficult to anticipate. Events connected with this violence and threats cause only 1.7% of the accidents but 4.5 % of the fatalities, which is close to that for the deviations 10 and 20 (see point 1).

4.2.1 The contact mode of injury

In the Eurostat system, an accident's "contact mode of injury" expresses the hazard that was the direct cause of the injury (trauma) of the victim. The definition of contact mode of injury is "the contact that injured the victim" and describes how the victim was hurt (physical or mental trauma) by the agent that caused the injury (see Appendix 3). Table 4 shows that a total of 33.5 % of the accidents provide no information on contact mode of injury and 66.5 % of accidents with information about contact mode of injury. It is assumed that the accidents with information are representative of the total.

Table 4 Registered accidents at work in 2009-2010 reported to Eurostat from 28 European countries, according to severity of the accidents and information about the contact mode of injury

	Fatal	**Most serious non fatal injuries**	**1-3 month**	**14-30 days**	**4-13 days**	**Unknown**	**Total**
No information	1,950 (21.8 %)	156,153 (42.5 %)	291,626 (36.1 %)	391,195 (35.2 %)	626,435 (37.9 %)	42,131 (7.6 %)	1,509,490 (33.5 %)
With information	6,998 (78.2 %)	211,258 (57.5 %)	516,858 (63.9 %)	719,951 (64.8%	1,024,461 (62.1 %)	510,421 (92.4 %)	2,989,947 (66.5 %)
Total	8,948 (100 %)	367,411 (100 %)	808,484 (100 %)	1.111,146 (100 %)	1,650,896 (100 %)	552,552 (100 %)	4,499,437 (100 %)

The 66.5 % of the accidents with information about contact mode of injury is shown in Table 5. The following points are made concerning this table.

Table 5 Registered accidents at work in 2009-2010 reported to Eurostat from 28 European countries, according to severity of the accident and the type of contact mode of injury. The percentage is made for the columns.

	Fatal	Most serious non fatal injuries	1-3 month absence	14-30 days absence	4-13 days absence	Unknown	Total
10. Contact with electrical voltage, temperature, hazardous sub.	499 (7.1 %)	3,338 (1.6 %)	9,026 (1.7 %)	19,540 (2.7 %)	38,453 (3.8 %)	14,957 (2.9 %)	85,813 (2.9 %)
20. Drowned, buried, enveloped	312 (4.5 %)	347 (0.2 %)	522 (0.1 %)	747 (0.1 %)	1,899 (0.2 %)	216 (0.04 %)	4,043 (0.1 %)
32. Horizontal motion, crash or against, resulting from fall	404 (5.8 %)	14,163 (6.7 %)	40,698 (7.9 %)	54,227 (7.5 %)	67,871 (6.6 %)	16,847 (3.3 %)	194,210 (6.5 %)
31. Vertical motion, crash or against and 39. other resulting from fall	1,510 (21.6 %)	65,374 (30.9 %)	127,697 (24.7%)	135,267 (18.8 %)	160,185 (15.6 %)	146,160 (28.6 %)	636,193 (21.3 %)
40. Struck by object in motion, collision	2,392 (34.2 %)	32,444 (15.4 %)	89,166 (17.3 %)	113,823 (15.8 %)	161,799 (15.8 %)	61,807 (12.1 %)	461,431 (15.4 %)
50. Contact with sharp, pointed, rough, coarse object	277 (4.0 %)	28,744 (13.6 %)	72,918 (14.1 %)	122,957 (17.1 %)	221,741 (21.6 %)	67,330 (13.2 %)	513,967 (17.2 %)
60.Trapped, crushed	1,067 (15.2 %)	15,362 (7.3 %)	39,040 (7.6 %)	40,901 (5.7 %)	49,458 (4.8 %)	23,670 (4.6 %)	169,498 (5.7 %)
70. Physical or mental stress	109 (1.6 %)	42,843 (20.3 %)	117,187 (22.7 %)	206,115 (28.6 %)	285,849 (27.9 %)	96,606 (18.9 %)	748,709 (25.0 %)
80. Bite, kick by animals or humans	132 (1.9 %)	3,127 (1.5 %)	9,179 (1.8 %)	12,558 (1.7 %)	20,291 (2.0 %)	35,462 (6.9 %)	80,749 (2.7 %)
99.Other contacts	296 (4.2 %)	5,516 (2.6 %)	11,425 (2.2 %)	13,816 (1.9 %)	16,915 (1.7 %)	47,366 (9.3 %)	95,334 (3.2 %)
Total	6,998 (100 %)	211,258 (100 %)	516,858 (100 %)	719,951 (100 %)	1,024,461 (100 %)	510,421 (100 %)	2,989,947 (100 %)

1. Especially dangerous hazards are connected to contact mode of injury 10 and 20, such as electricity, temperature, chemicals, lack of oxygen in connection with drowning, burial and envelopment. These cover 3.0 % (89,856) of all the accidents but 11.6 % (811) of the fatal accidents. This indicates that these injury-causing conditions are particularly dangerous but do not occur often.

2. Hazards connected to contact mode of injury 30 where the victim's own movement in either a horizontal or vertical direction cause mostly injuries connected with the victim hitting something while falling or stumbling and also covers injuries caused when the victim is moving in a means of transport that is hit or crashes into something. The hazards connected with the victim's own movement cover 27.8 % (830,403) of the accidents. The horizontal movement accidents are fairly equally spread across the different categories of severity, while the vertical motion results in rather many fatalities 22 % and most severe consequences 31 %.

3. Hazards connected to contact mode of injury 40 where the victim is hit by an object, technical equipment, or something else that is moving. The injuries caused by a moving object comprise 15.4 % (461,431) of the accidents. Of these injury-causing conditions, a large share, 34.2 % (1,067), resulted in fatalities

4. Hazards connected to contact mode of injury 50 and 60 that cut, stick, tear. The injury-causing conditions connected with objects that are sharp, tear, trap, or crush comprises 22.9 % (683,465) of the accidents. These injury-causing conditions comprise an almost corresponding share within all seriousness categories.

5. Hazards connected to contact mode of injury 70 from acute physical or mental stress and violence comprise 25 % (748,709) of the accidents. These conditions are fatal to only a small degree but they cause a good deal longer absence from work.

6. Hazards connected to contact mode of injury 80 due to bite, kick by animals or humans are comprised of only a small proportion of injuries 2.7 % but just as many as electrical voltage, temperature and hazardous substances.

5. DISCUSSION AND CONCLUSIONS

Although it is generally known that there are different types of accidents – as shown by deviations and contact modes of injury – safety initiatives and accident prevention are often treated as if they were dealing with a single problem. Analysis of the Eurostat data shows that serious accidents measured on the basis of absence from work and fatalities are coupled with many different types of deviations and contact modes of injury. The Major hazards that are usually considered especially dangerous cause only a small share of accidents (maximum 11.3 %), whereas the Minor hazards are dominating, these being body movement causes (41.8 %) and slipping, stumbling and falling (23.3 %). A large share of the loss of control over machines and tools, which causes 21.5 % of the accidents, is most often related to wrong use of the technical equipment but without questioning about the wrong use is because of poor design of the equipment, lack of instruction in the use, poor maintenance etc.

What is characteristic and common for all accidents is that they occur suddenly, are unexpected, and they cause injury immediately. However, the direct causes can be very different and are generally connected with the type of hazard and accidental event, while the root causes are related to a long series of conditions such as management, organization, planning, training, competences etc.(Jørgensen, et al., 2010), (Jørgensen, K., 2015)

Looking at the information from Eurostat and the spread and frequencies across the different severity categories, you can discuss what the prevention strategy should focus on. In fact the prevention strategy has to be for all the different kinds of deviations and contact modes of injury in which the hazard is realised if the prioritisation of preventing the severe accidents should be obtained. Severity distributions differ a lot according to the nature of the hazard and the way in which contact with the hazard comes about. This arise the question what really to focus on and what activity to prioritize

The analysis shows that it is the minor hazards associated with the more simple accidental events that exist in most people's daily working life like walking around, working on heights, carrying things, using technical equipment which are the most frequent.

Safety barriers include both technical solutions, where focus should be on correct use, good maintenance, and good control, and behavioural safety measures, where the focus should be on procedures, plans, accessibility, competences, commitment, coordination etc. (Hale & Guldenmund, 2003) (Jørgensen, K., 2015) .

Going through all the different hazards and related safety barriers Linda Bellamy find that for the same hazards you find the same missing safety barrier for both the severe consequences as for the minor consequences. But she also finds that there is a big difference in which safety barrier that has been missing between different hazards (Bellamy 2014).

The conclusion could be that we maybe not focus so much on the severity of the consequences but more on how to raise the awareness for different hazards and minimizing accidental event through control of safety barriers.

It is very difficult to achieve a good understanding of hazards and awareness of hazards. Research shows that misunderstanding the probability of accidents, the media's influence regarding risk levels, and misleading personal experiences often create erroneous judgements in the form of either underestimating or overestimating risk (Lin & Petersen, 2007). For the last 10 years, research and development in the prevention of work accidents has been about strengthening safety management and safety culture in enterprises. It has also been shown that

there is a need for a broad effort aimed at changing both behaviour and attitudes, while also making structural changes (Lund & Aarø, 2004). After an accident has happened it can be quite easy to see what should have been done but this is not the case before an accident; on the contrary, situations where accidents occur look very similar to many other situations where nothing happens.

The challenge is to set a focus on the different types of hazards, the deviations which lead to them being realised and the ways in which they cause harm and to show how we can observe and evaluate their possibilities for causing an accident. This knowledge should be widely disseminated because the Minor hazards are widely found in most people's daily work. It can be discussed what should be done to increase people's awareness of these hazards, which most people consider to be so minor that they would react with "Can't you watch out" or "See where you're going" or "Be careful now". This is what happens in most cases when Minor hazards lead to accidents, and it is the main reason why efforts to do something about such accidents do not succeed.

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REFERENCES:

European Commission (2011). Commission Regulation (EU) No. 349/2011 of 11 April 2011, implementing Regulation (EC) No. 1338/2008 of the European Parliament and of the Council on Community statistics on public health and safety at work, as regards accidents at work.

Bellamy l. (2014). Exploring the relationship between big and small consequence accidents through their underlying causes, Safety Scinece 2014.(not yet published)

Eurostat (2013,1). *Accidents at work and work related health problem data*, http://epp.eurostat.ec.europa.eu/portal/page/portal/health/accidents_work_work_related_health_problems/data/database

Eurostat (2013,2). *European Statistics on Accidents at Work (ESAW) Summary methodology*. European Commission, Luxembourg. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-12-102/EN/KS-RA-12-102-EN.PDF

Eurostat request DK533 (2013) :https://ec.europa.eu/eurostat/xtnetassist/login.htm?requestId=DK533

Glendon, A., Clarke, S. & McKenna, E: (2007). Human Safety and Risk Management. 2 red. s.l.: Taylor & Francis.

Heinrich, H.W. (1931). Industrial Accident Prevention, a Scientific Approach. McGraw Hill, New York.

Jørgensen, K. (2008). *A systematic use of Information from accidents as a basis of prevention activities*. Safety Science, vol. 46(2), pp. 164-175.

Jørgensen, K., Duijm, N. & Troen, H. (2010). *Risk Assessment and Prevention of occupational accidents - report no. 4*. s.l.: DTU Management Engineering.

Lin, I. & Petersen, D. (2007). *Risk Communication in Action – The tools of message mapping*, Cincinnati: EPA/625/R-06/012, United States Environmental Protection Agency.

Lund, J. & Aarø, L. (2004). *Accident prevention. Presentation of a model placing emphasis on human, structural and cultural factors*. Safety Science, vol. 42, pp. 271-324.

Rasmussen, J. & Svedung, I. (2000). *Proactive Risk Management in a Dynamic Society*. Sweden: Räddningsverket.

Woodruff, J.M. (2005). *Consequence and likelihood in risk estimation: A matter of balance in UK health and safety risk assessment practice*. Safety Science, vol. 43, pp. 345–353

Appendix 1 Days lost (severity) (Eurostat 2013)

Code Label

000 Number of days lost unknown

004 - 182 Number of whole days lost in numerical (less than 6 months' absence)

A01 4 - 6 days lost

A02 7 - 13 days lost

A03 14 - 20 days lost

A04 At least 21 days but less than 1 month lost

A05 At least 1 month but less than 3 months lost

A06 At least 3 months but less than 6 months lost

997 Permanent incapacity (to work) or 183 or more days lost (6 months' absence or more).

998 Fatal accident

Appendix 2 Deviation (Eurostat 2013)

Code Label

00 No information

10 Deviation due to electrical problems, explosion, fire - Not specified

20 Deviation by overflow, overturn, leak, flow, vaporisation, emission - Not specified

30 Breakage, bursting, splitting, slipping, fall, collapse of Material Agent - Not specified

40 Loss of control (total or partial) of machine, means of transport or handling equipment, hand-held tool, object, animal - Not specified

50 Slipping - Stumbling and falling - Fall of persons - Not specified

60 Body movement without any physical stress (generally leading to an external injury) - Not specified

70 Body movement under or with physical stress (generally leading to an internal injury) - Not specified

Appendix 3 Contact-Mode of injury (Eurostat 2013)

Code Label

00 No information

10 Contact with electrical voltage, temperature, hazardous substances - Not specified

20 Drowned, buried, enveloped - Not specified

30 Horizontal or vertical impact with or against a stationary object (the victim is in motion) - Not specified

40 Struck by object in motion, collision with - Not specified

50 Contact with sharp, pointed, rough, coarse Material Agent - Not specified

60 Trapped, crushed, etc. - Not specified

70 Physical or mental stress - Not specified

80 Bite, kick, etc. (animal or human) - Not specified

99 Other Contacts - Modes of Injury not listed in this classification